

Meal Ideas  
and Menus:  
Avoiding  
High-tyramine  
Foods Made Easy

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## Your MAO-B inhibitor, mealtime, and you

Staying healthy is important to everyone. The quality of our lives depends in great part on our good health, especially when managing the effects of Parkinson's disease (PD). A nourishing diet, regular exercise, and the right medications are key to a healthy, active life for people with PD.<sup>1</sup>

In some cases, foods and beverages—even healthful foods and beverages—can have unfavorable interactions with certain medications. One such class of medications is *monoamine oxidase inhibitors* (MAOI) and *monoamine oxidase type B inhibitors* (MAO-BI). These can interact with a substance called *tyramine* to cause serious problems.<sup>2</sup> To best understand the nature of the interaction between tyramine and medications, it may be helpful to define and discuss several important terms. But if you are not interested in this, skip ahead to the tables listing foods to avoid and foods you can eat and the sample menus.

### What is tyramine?

Tyramine is a *monoamine compound*—a substance that is found naturally in some foods, plants, and animals.

It can also be produced in foods and beverages as a result of fermentation, aging, or spoilage. Tyramine is important because it can affect blood pressure. Examples of foods that contain high amounts of tyramine include aged cheese, soy sauce, aged meats, pickled fish, tofu (soy curd), sauerkraut, and tap beer.<sup>2</sup>

### What is monoamine oxidase (MAO)?

*Monoamine oxidase (MAO)* is an enzyme found in nerve endings, the liver, gastrointestinal tract, and brain. In the gut, it guards against the buildup of substances that could be dangerous. There are 2 types of MAO—MAO type A (MAO-A), which is found primarily in the liver and gastrointestinal tract, and MAO type B (MAO-B), which is found primarily in the nervous system, including the brain.<sup>3</sup>

MAO changes tyramine and other amine-containing compounds into a harmless substance that is then excreted from the body. It also breaks down several messengers for the nervous system including the brain, known as *monoamine neurotransmitters*. Two examples are norepinephrine (also known as noradrenaline), which helps regulate blood pressure, and serotonin, which influences our mood.<sup>3</sup>

MAO also breaks down dopamine, another neurotransmitter. In PD, this can be a problem, because the brain already has decreased production of dopamine due to loss of specific nerve cells. Lack of dopamine is the cause of PD symptoms such as tremor and slowed movement. Further breakdown of dopamine by MAO can contribute to these PD symptoms.<sup>3</sup>

## What is a monoamine oxidase inhibitor?

*Monoamine oxidase inhibitors* (MAOIs) are medications that slow the enzyme monoamine oxidase (MAO) in its breakdown of amine compounds including neurotransmitters, such as norepinephrine, serotonin, and dopamine. MAOIs also slow the breakdown of tyramine, another monoamine compound.<sup>3</sup>

There are 3 types of MAOIs, those that inhibit both MAO-A and MAO-B and those that preferentially or selectively inhibit only MAO-B or only MAO-A at the doses used. The type of MAO inhibitor used to treat symptoms of PD is the MAO-B inhibitor (MAO-BI). It is important to note that even those MAO inhibitors that are selective for MAO-B can at high doses also begin to inhibit MAO-A.<sup>3</sup>

MAO-BIs slow the destruction of dopamine by monoamine oxidase type B, which is the main type in the brain. So, although the brain is producing less dopamine, the MAO-BIs make the dopamine last longer. By slowing the breakdown, MAO-BI medications help to prolong the useful activity of the dopamine, and this helps in managing PD symptoms.<sup>3</sup>

## What happens when a person taking MAOIs and MAO-BIs eats foods high in tyramine?

Normally, tyramine in foods is inactivated by the MAO-A enzyme in the gut. But if a person is taking a medication that inhibits MAO-A (a nonselective MAOI or MAO-BI at too high a dose) and eats foods high in tyramine, the tyramine may not be broken down and can build up in the blood.<sup>3</sup> Increased amounts of tyramine in the blood are not desirable. Large amounts of tyramine can cause the release of excess norepinephrine, which can constrict the blood vessels, causing blood pressure to rise, sometimes to a dangerously high level. If blood pressure increases to a dangerous level, this condition is called a *hypertensive crisis*. When this is caused by too much tyramine in food, it is called a “*cheese reaction*” or the “*cheese effect*.”<sup>2,3</sup>

This is because in the early days of MAOI use, it was noticed that some people experienced headaches after eating cheese. Even today, this is known as the “cheese effect” or “cheese syndrome,” but other foods and beverages high in tyramine can also cause the symptoms.<sup>2</sup>

## What is a “hypertensive crisis” or “cheese reaction”?

A hypertensive crisis means that blood pressure has risen to dangerously high levels—systolic pressure (the top number) rising 30 mm Hg or more and diastolic pressure (the bottom number) increased to more than 120 mm Hg. In extreme cases, it can lead to organ damage or even a stroke.<sup>4</sup>

## What are the symptoms of hypertensive crisis?

Possible symptoms of hypertensive crisis include

- Severe headache
- Blurred vision
- Difficulty thinking
- Seizure
- Chest pain
- Nausea/vomiting
- Signs or symptoms of a stroke

People taking an MAOI including MAO-AI and MAO-BI at too high a dose should be careful about what they eat or drink to make sure they avoid a possible hypertensive crisis or cheese reaction.<sup>2</sup>

## How do I choose, store, and prepare safe foods?

Tyramine is produced in some plants and also can be a product of aging, curing, fermentation, and spoilage of produce, dairy products, and meats.

However, the tyramine content of foods and beverages can vary a great deal. Produce ripening time may vary, different fermentation and processing methods may have been used, and degree of spoilage may vary from overripe to actual decay.

The following guidelines will help in choosing foods and beverages<sup>5</sup>:

Storing foods at room temperature can increase tyramine levels. All fresh foods should be stored in the refrigerator or freezer. However, even refrigerated fresh produce can have an increase in tyramine content if stored for several days, so it is important to consume fresh produce within 48 hours of purchase.

- Eat fresh-canned or fresh-frozen foods, including produce, meats, poultry, and fish. In the case of canned or frozen foods, use immediately after opening.
- Purchase fresh meats, poultry, and fish, and eat them the same day or freeze right away.
- Thaw foods in the refrigerator or microwave; thawing out on the counter at room temperature could allow formation of tyramine.
- Avoid any food that has been spoiled (including overripe produce, or cottage cheese with mold, for example). Avoid foods that have been aged, fermented, or pickled (See table “Foods and beverages to avoid”).
- Aged, fermented, cured, smoked, and pickled foods include most nonprocessed cheeses, dry sausage, sauerkraut, pickled herring, soy sauce, miso soup, and concentrated yeast extracts (Marmite®, Vegemite®). Plant foods to avoid include fava beans, broad beans (Italian green beans), snowpeas, and banana peels.

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Vegemite is a trademark of Kraft Foods Limited.

- Heat does not destroy tyramine; therefore, cooking produce or other foods will not lower tyramine content.
- Use caution when eating in restaurants or at other times when storage conditions cannot be determined.
- More than three fourths of all hypertensive crises and nearly all fatal cases of hypertensive crisis have been due to aged (but not processed) cheeses, so it will be especially important to avoid these food items.
- If you stop taking your MAO-B inhibitor, continue to follow these guidelines for 2 weeks.

## Amounts of tyramine that may cause hypertensive reactions when MAO-A is inhibited<sup>5</sup>

Milligrams (mg) of Tyramine	Possible Reaction
6-8 mg	Elevated blood pressure, nausea/vomiting, quickened heart rate
10-25 mg	Headache, severe headache, possible bleeding into the brain (stroke)
More than 25 mg	Hypertensive crisis

## What foods and beverages should I avoid based on tyramine content?

The following tables should help in choosing foods and beverages that are safe, foods and beverages that may be consumed occasionally (no more than 3 servings of “occasional” foods per day), and those that should be avoided completely.

The table “Foods and beverages to avoid” lists the tyramine content by portion size of items to avoid if you are taking a medication that inhibits MAO-A (a nonselective MAOI or MAO-BI at too high a dose).

## Foods and beverages to avoid

CHEESES	PORTION SIZE	TYRAMINE CONTENT (if known)
NOTE: Avoid all cheeses except those listed in the “Foods and beverages to eat or drink occasionally” and “Foods and beverages to eat or drink without restriction” tables.		
Canadian cheddar	1 oz (28 g)	43 mg
New York cheddar	1 oz (28 g)	42 mg
Stilton	1 oz (28 g)	33-61 mg
Camembert	1 oz (28 g)	38 mg
Swiss	1 oz (28 g)	28 mg
Bleu/blue, Gorgonzola	1 oz (28 g)	28 mg and 1.6 mg, respectively
Casseroles or other products made with aged cheeses	1 cup (8 oz, 224 g)	Unknown, but considered to be high
ALCOHOLIC BEVERAGES	PORTION SIZE	TYRAMINE CONTENT (if known)
Vermouth	1 oz (29 mL)	Unknown, but considered to be high
Tap beer	12 oz (355 mL)	38 mg
Korean beer	12 oz (355 mL)	Unknown, but considered to be high
MEAT, POULTRY, FISH	PORTION SIZE	TYRAMINE CONTENT (if known)
Dry sausages (such as mortadella)	1 oz (28 g)	3-43 mg
Salami, including Genoa salami, hard salami, cacciatore	1 oz (28 g)	1.2-5.4 mg
Chinese dried duck	4 oz (112 g)	Unknown, but considered to be high
Chicken livers, aged	1 oz (28 g)	60 mg
Smoked or pickled fish (lox, caviar)	1 oz (28 g)	Unknown, but considered to be high
Pickled herring (in brine)	1 oz (28 g)	0-86 mg
Caviar	1 tablespoon (15 g)	Unknown, but considered to be high
Soups or casseroles containing meat extracts (such as bouillon, beef broth), soy products, or cheese	Varies	Varies
Gravies or sauces containing meat extracts (such as bouillon, beef broth), soy products, or cheese	Varies	Varies

## Foods and beverages to avoid (cont.)

PRODUCE	PORTION SIZE	TYRAMINE CONTENT (if known)
Sauerkraut	4 oz (112 g)	3.5-14 mg
Fava beans and broad beans (Italian green beans) and their pods	—	These beans contain dopa, which is converted to dopamine and can act to raise blood pressure, as with tyramine
Banana peel	1 peel or 1 oz	1.4 mg/peel to 1.8 mg per 1 oz
Kim chee	4 oz (112 g)	Unknown, but considered to be high
Miso soup, fermented soy bean/bean curd, tofu	2 oz (56 g)	Unknown, but considered to be high
CONDIMENTS	PORTION SIZE	TYRAMINE CONTENT (if known)
Concentrated yeast extract (Marmite®, Vegemite®)	1 US tablespoon (15 g)	1.5-34 mg
Soy sauce	1 US teaspoon (5 mL)	0.05-4.7 mg
Thai or Vietnamese fish sauce	1 US teaspoon (5 mL)	0-3.7 mg

## Foods and beverages to eat or drink occasionally

*Choose up to 3 servings per day from among the following foods; may choose 3 servings of the same food or 1 serving each of 3 different foods.*

CHEESE & DAIRY	PORTION SIZE	TYRAMINE CONTENT (if known)
American cheese, pasteurized processed American cheese (such as Schwan's, Kroger, or Borden's American processed cheese; Kraft Velveeta®, Cheez Whiz®)	1 oz (28 g)	0.2-1.6 mg
Parmesan cheese	1/2 oz (14 g)	0.05-4.1 mg
Farmers cheese, havarti, brie, Boursin® cheese	1 oz (28 g)	Considered to be low
ALCOHOLIC BEVERAGES	PORTION SIZE	TYRAMINE CONTENT (if known)
Red or white wine	4 oz (116 mL)	0-0.6 mg
Beers, canned/bottled	12 oz (355 mL)	1.5 mg
Beer, bottled, alcohol free	12 oz (355 mL)	Considered to be low

## Foods and beverages to eat or drink occasionally (cont.)

MEAT, POULTRY, FISH	PORTION SIZE	TYRAMINE CONTENT (if known)
Pepperoni	1 oz (28 g)	1.75 mg
Wild game meat	4 oz (112 g)	Considered to be low
Pizza (homemade or gourmet pizzas may have higher tyramine content)	2 slices	Pizzas from large chain commercial outlets are safe for consumption with MAOIs. However, caution must be exercised if ordering pizzas from smaller outlets or gourmet pizzas known to contain aged cheeses.
Anchovies	1 tablespoon (15 g)	Considered to be low
Snails	1/4 cup (60 g)	Considered to be low
PRODUCE	PORTION SIZE	TYRAMINE CONTENT (if known)
Raspberries and canned figs	1/2 cup (100 g)	Considered to be low
CONDIMENTS	PORTION SIZE	TYRAMINE CONTENT (if known)
Thai or Vietnamese fish sauce	1/4 teaspoon (1.25 mL)	About 1 mg

## Foods and beverages to eat or drink without restriction

CHEESE, DAIRY, DAIRY ALTERNATIVES	PORTION SIZE	TYRAMINE CONTENT (if known)
Romano cheese	1 oz (28 g)	0.1 mg
Cottage cheese	4 oz (112 g)	0
Ricotta cheese	2-4 oz (56-112 g)	0
Cream cheese	2 oz (56 g)	0
Sour cream	1 oz (28 g)	0.03 mg
Yogurt	8 oz (224 g)	Considered to be low
Fresh milk	8 oz (236.6 mL)	Considered to be low or nonexistent
Ice cream	4 oz (118.3 mL)	Considered to be low or nonexistent
Soy milk alternative	8 oz (232 mL)	Considered to be low or nonexistent
ALCOHOLIC BEVERAGES (Use in moderation)	PORTION SIZE (Use in moderation)	TYRAMINE CONTENT (if known)
Gin	2 oz (59 mL)	0
Vodka	2 oz (59 mL)	0
Rum	2 oz (59 mL)	0
Bourbon	2 oz (59 mL)	0



## Foods and beverages to eat or drink without restriction (cont.)

<b>MEAT, POULTRY, FISH, EGGS</b>	<b>PORTION SIZE</b>	<b>TYRAMINE CONTENT (if known)</b>
All fresh meats, poultry, and fish, including fresh chicken livers; should be cooked and eaten on day of purchase or frozen/canned	2-4 oz (56-112 g)	Considered to be low or nonexistent
All canned meats, poultry, and fish; should be eaten immediately after opening	2-4 oz (56-112 g)	Considered to be low or nonexistent
Luncheon meats (eg, cooked sliced ham, hot dogs) except those listed in “Foods and beverages to avoid” table	2-4 oz (56-112 g)	Considered to be low or nonexistent
Fresh sausage, such as breakfast sausage patties	2-4 oz (56-112 g)	Considered to be low or nonexistent
Fresh eggs, eaten immediately after cooking	1 daily	Considered to be low or nonexistent
Cooked dried beans, peas, and lentils except for fava beans	1-2 cups daily	Considered to be low or nonexistent
<b>PRODUCE</b>	<b>PORTION SIZE</b>	<b>TYRAMINE CONTENT (if known)</b>
All fresh, canned, or frozen vegetables and fruits except those listed in “Foods and beverages to avoid” table	1/2 to 1 cup (aim for at least 5 servings per day)	Considered to be low or nonexistent
Raisins	2 tablespoons (1 oz, 28 g)	Considered to be low
<b>CONDIMENTS</b>	<b>PORTION SIZE</b>	<b>TYRAMINE CONTENT (if known)</b>
Ketchup, mustard, Worcestershire sauce, and salad dressings except those containing items listed in “Foods and beverages to avoid” table	1 tablespoon (14 g)	Considered to be low or nonexistent
<b>MISCELLANEOUS</b>	<b>PORTION SIZE</b>	<b>TYRAMINE CONTENT (if known)</b>
Yeast bread	2 slices	Considered to be low or nonexistent
Coffee, tea, and soft drinks	4-12 oz (118-355 mL)	Considered to be low or nonexistent
Chocolate	1 oz (28 g)	Considered to be low or nonexistent

## Meals and menus

It is important to understand which foods and beverages are safe and which could be a problem. It's equally important to know how to plan meals using safe foods and beverages. Following are some menus and recipes to help you get started.

Please note that:

- Foods shown in italics indicate those to be eaten only occasionally (see pages 7-8). Do not have more than 3 items per day from this group.
- Asterisks (\*) indicate that a recipe is available on page 12.

### MENU #1

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#### *Morning*

Omelet with *1 oz processed American cheese*, such as Velveeta®  
2-oz breakfast sausage patty  
Toast, preferably whole grain; butter, jam, jelly, or preserves  
Coffee or tea; milk, cream, sugar as desired  
Orange juice or other fresh, frozen reconstituted, or canned fruit juice  
(consume product within 48 hours)

#### *Midday*

Tuna salad sandwich\*  
Banana  
Carrot and celery sticks  
Tomato juice (consume fresh, frozen, or canned product  
within 48 hours)

#### *Evening*

*4 oz of red or white wine or 12-oz can or bottle of beer (no Korean beer)*  
Steak or pork chop (fresh, not aged)  
Baked potato with 2 tablespoons *sour cream*  
Steamed carrots or summer squash with butter  
Bread or dinner roll with butter  
Ice cream

## MENU #2

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### *Morning*

Breakfast cereal with milk or soy milk alternative  
Orange juice or other fresh, frozen reconstituted, or canned fruit juice (consume product within 48 hours)  
Bagel or English muffin with butter, jam, jelly, or cream cheese  
Coffee or tea; milk, cream, sugar as desired

### *Midday*

Split pea soup  
Crackers with 1 oz *brie or havarti cheese*  
Juice, milk, or soy milk alternative

### *Evening*

4 oz of *red or white wine or 12-oz can or bottle of beer (no Korean beer)* or soft drink  
2 slices *pizza* (not gourmet or homemade)  
Tossed salad with non-cheese dressing  
Cake or pie  
Coffee or tea; milk, cream, sugar as desired

## MENU #3

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### *Morning*

Pancakes with butter and syrup  
Milk or soy milk alternative  
1/2 cup fresh grapes or other fruit  
Coffee or tea; milk, cream, sugar as desired

### *Midday*

Chicken, turkey, or roast beef sandwich with 1 oz *processed cheese*  
Tomato slices  
Fruit or vegetable juice (consume fresh, frozen, or canned product within 48 hours)

### *Evening*

4 oz of *red or white wine or 12-oz can or bottle of beer (no Korean beer)*  
Shrimp scampi with linguini  
Steamed broccoli with lemon juice and butter  
Garlic bread  
Tiramisu  
Coffee or tea; milk, cream, sugar as desired

## Snacks

Snacks can be very important, especially for those with slowed stomach emptying or who experience unplanned weight loss. Try to have nutritious snacks rather than “empty calorie” foods. Here are some examples:

- Yogurt, 8 oz, with 1/2 cup fresh fruit
- Hard-cooked egg
- Fruit smoothie\*
- 1/2 cup grapes, berries, or cherries
- Apple, pear, orange, or other fresh fruit with 1/2 cup cottage cheese
- Whole-grain crackers with peanut butter
- 1 oz *havarti*, *brie*, or *Boursin*® cheese, with whole-grain crackers

## Recipes

### **Tuna Salad Sandwich**

- 3-oz can tuna
- 2 tablespoons mayonnaise
- 1 tablespoon chopped green onion
- 1 tablespoon pickle relish
- 1 tablespoon chopped celery
- 1 slice tomato
- 1 large lettuce leaf
- 2 slices whole-grain bread

In medium bowl, flake tuna. Add mayonnaise, onion, pickle relish, and celery, and stir to combine. Spread on one slice of bread; top with tomato slice and lettuce leaf and remaining slice of bread. (Note: bread can be toasted if you prefer.)

### **Fruit Smoothie**

- 1 cup frozen strawberries
- 1/2 banana
- 1/2 8-oz container lemon yogurt
- 1 cup milk or soy milk alternative
- 1 tablespoon honey
- 1/2 teaspoon vanilla

Place all ingredients in blender container and blend until smooth.

## Further resources

Individuals have many different nutritional and diet-related needs, depending on gender, age, medications used, and diagnosed conditions, including Parkinson's disease. Talk to your doctor about your personal nutritional and dietary needs. You may also ask your doctor for a referral to a registered dietitian (RD), or search online for an RD in your area at:

### **American Dietetic Association**

[www.eatright.org](http://www.eatright.org)

Click on the link "Find a Nutrition Professional"

For online information regarding hypertensive crisis ("cheese reaction"):

### **Mayo Clinic**

[www.mayoclinic.com/health/hypertensivecrisis/AN00626](http://www.mayoclinic.com/health/hypertensivecrisis/AN00626)

### **The Cleveland Clinic**

[www.clevelandclinicmeded.com/diseasemanagement/nephrology/crises/crises.htm](http://www.clevelandclinicmeded.com/diseasemanagement/nephrology/crises/crises.htm)

The author, Kathrynne Holden, is a registered dietitian with a master's degree in nutrition. She has authored *Eat Well, Stay Well with Parkinson's Disease*, and *Cook Well, Stay Well with Parkinson's Disease*, as well as numerous articles on nutritional concerns in Parkinson's disease; for information, see [www.nutritionucanlivewith.com](http://www.nutritionucanlivewith.com). She also moderates the online forum "Ask the Parkinson Dietitian" at the National Parkinson Foundation Web site [www.parkinson.org](http://www.parkinson.org).





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